November 21, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
TEXAS UTILITIES GENERATING COMPANY, et al.	)	Docket Nos. 50-445-2 and 50-446-2
	)	
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	(Application for Operating Licenses)

OL-2

PREFILED TESTIMONY OF C. THOMAS BRANDT REGARDING CASE'S FURTHER "EVIDENCE" OF A QUALITY CONTROL BREAKDOWN IN THE CONSTRUCTION, INSTALLATION AND INSPECTION OF THE STAINLESS STEEL LINER PLATE

Q1. Mr. Brandt, have you had an opportunity to review the memorandum concerning the stainless steel liner plate filed by the Citizens Association for Sound Energy on November 15, 1984?

A1. Yes.

Q2. Mr. Brandt, directing your attention to page two of that memorandum, CASE contends that applicants incorrectly assert that the liner plate is not safety-related. Do you see that passage?

A2. Yes. It is set out in the first three paragraphs on the page.

Q3. Is that contention correct?

A3. No. CASE's contention shows a lack of understanding of my testimony and the procedures applicable to the fabrication and installation of the stainless steel liner plate. As I testified before, the fabrication and installation of the stainless steel liner have been designated safety-related activities by the architect engineer. I would like to note my testimony on this point appears at page 45,315 of the transcript of this proceeding. Therefore, CASE is factually incorrect when it asserts that applicants have testified that the liner plate is not safety related. What I testified to, and what CASE appears not to understand, is that the welds in question are non-structural; this point is different from, and unrelated to, the fact that the fabrication and installation of the liner plate are safety-related activities.

The significance of the welds being non-structural is that the architect-engineer did not impose stringent requirements such as those imposed by the ASME code, for the fabrication, installation, inspection and testing of the liner and the welding associated with these activities. The architect-engineer's only concern was that the welds not leak. Accordingly, welding on the liner place is not now, nor has it even been, under the jurisdiction of the ASME Code.

Only two matters remotely tie the liner plate to ASME activities, but neither of these matters apply ASME fabrication and installation requirements to the liner plate.

First, the specification for the liner plate requires that welders who work on, and welding procedures used in connection with, the liner plate be qualified in accordance with Section IX of the ASME Code. This Section, however, is limited to the qualifications of procedures and welders, and it is not a fabrication code. Accordingly, the Code's fabrication requirements simply do not apply to the liner plate. Second, as an administrative matter, the inspection group originally assigned to perform these inspections was the ASME group. In February 1982, responsibility for these inspections was transferred to the non-ASME inspection group; this transfer was also an administrative matter. Again, I want to emphasize that these assignments were unrelated to the applicability of the ASME Code requirements to the fabrication and installation of the liner plate.

Q4. Mr. Brandt, directing your attention to pages two and three of CASE's memorandum, CASE asserts that the correct traveler form was used for weld no. 988, and that you either were wrong in testifying that all travelers were initiated on the wrong form or that you knew that some travelers were initiated on the correct form and your testimony was deceptive. Do you see these allegations?

A4. Yes, I do.

Q5. Is CASE correct?

A5. No. First, my testimony was that I could find no evidence that the correct traveler form was used before April 18, 1979. My review of the travelers indicates that the correct form was used after that date. Second, all of my testimony, as I have stated several times, is limited to the travelers for the Unit 2 refueling cavity, which is located inside the Unit 2 reactor building. All thirteen hundred travelers at issue in this proceeding are for that cavity. I would like to point out that I made this point on pages 15,921-923, 15,927 of the transcript of this proceeding. Traveller 988 cited by CASE is not for a weld in this cavity. It is for a weld in the Unit 2 fuel transfer canal, which is located inside the fuel building. This is not only a completely different cavity; it is for a cavity located in a completely different building. Thus, CASE's allegation is premised on a traveler that was not even included in the travelers that were the subject of my testimony.

Q6. Directing your attention to page 3 of Exhibit I to CASE's memorandum, CASE alleges that certain welds lack QC verification of the fit-up and cleanliness of the outside welds. In support of this allegation, CASE identifies a total of 147 welds which it claims lack QC verification of the fit-up and cleanliness of outside welds. Do you see those allegations?

A6. Yes I do.

Q7. Have you reviewed the travelers for these welds?

A7. Yes.

Q8. What were the results of your review?

A8. In each instance, I found that there was either a chit and/or a traveler documenting QC verification of the fit-up and cleanliness of the outside weld. Accordingly, CASE's allegation is factually wrong.

Q9. CASE asserts on page three of Exhibit 1, "it is evident that the chits [attached to the 147 travelers] were not intended to verify step 1, but was [sic] intended to verify Step 3 and/or 2 only." Is this correct?

A9. No. The chits themselves reflect that they document QC verification of the fit-up and cleanliness of the outside weld.

Q10. CASE also alleges on page 3 that 170 other welds lack QC verification for fit-up and cleanliness of the outside weld. Did you review the documentation for these welds?

A10. Yes.

Q11. What were the results of your review?

A11. With the exception of weld 326, I found that there was a chit and/or traveler substantiating the QC inspection of the fit-up and cleanliness of the concrete side of these welds. Thus, with the exception of weld 326, CASE's allegation is factually wrong.

Q12. Have you determined why there was no documentation verifying the cleanliness and fit-up of the outside weld for traveler 326?

A12. Yes, I have.

Q13. Why was documentation of the QC verification for this weld not found during your review?

A13. The weld has not been made. It is a weld between an angle and the top plate of the cavity, which as of November 20, 1984, had not yet been fit-up.

Q14. CASE next states on page four of Exhibit 1 that five welds lacked QC verification of fit-up and cleanliness for the outside welds prior to welding which allegedly renders their conditions indeterminate, contrary to procedure and 10 C.F.R. Part 50, Appendix B, Criteria V. Do you agree with this characterization?

A14. I cannot agree with CASE's position. I do agree with CASE's contention that, because of the dates of the signatures, the chits attached to these travelers do not definitely establish that the five cleanliness and fit-up inspections were performed prior the time the backing strip was tack-welded to the plates. This is a violation of site procedures, and I have directed that an NCR be written to address this deficiency.

While I agree that there is a paper problem with these five travelers, I cannot agree that the deficiency is technically significant. The fit-up of the plates associated with the travelers identified by CASE was reverified and documented and the cleanliness of the inside joint was verified and documented prior to making the inside welds. Under these circumstances, the verification of the fit-up and cleanliness of the plates prior to tack-welding the

backing strip to the plates is not a technical concern. The only purpose of verifying the cleanliness of the plates prior to tack-welding the backing strip to the plates was to assure that the backing strip could be securely tacked on and would not become dislodged inside the leak chase channel. The sole purpose for the inspection is to ensure that the backing strip remains in place until the time of the inside fit-up. The reason for verifying fit-up prior to tack-welding the backing strip to the plates was to prevent difficult rework which would be required after the attachment of the leak chase channel if the original fit-up between the plates was out of tolerance. In any event, if the backing strip had dislodged or if the fit-up have been improper those deficiencies would have been noted when the cleanliness and fit-up inspections were performed for the inside welds.

Q15. On page five of Exhibit 1, CASE identifies a number of welds which were done using welding procedure 88023 and claims that the correct procedure for those welds was welding procedure 88025. Do you agree with this assertion?

A15. No. The welds CASE identified are embed to plate welds. All welds made on the liner plates between embeds and plates are groove welds in which the deposited weld metal thickness (joint thickness) is .1875" (the thickness of the plate). The proper procedure for making this weld in 1978 was WPS 88023, which was qualified for thickness ranges .0625" through .750". Prior to October 15, 1979, WPS 88025

was qualified for welds with thicknesses of 0.75" through 3.5". On October 15, 1979, WPS 88025 was revised and the thickness range was expanded from 0.75" through 3.5" to 0.185" through 3.50". After this date either WPS 88023 or WPS 88025 could have been followed when making the welds to which CASE refers. Therefore, CASE is wrong in contending that the wrong procedure was used in making the referenced welds. To confirm my observations on this point, copies of WPS 88023, WPS 88025 and 1977 ASME IX, QW 202.2 are appended to my testimony as attachments 1, 2 and 3 respectively.

Q16. On page six of Exhibit 1, CASE identified 243 travelers which CASE claims lack QC verification for Step 5, fit-up and cleanliness of the inside welds. Have you reviewed the traveler packages for these welds?

A16. Yes.

Q17. What was the result of your review?

A17. It is difficult to understand CASE's allegations with respect to the various welds included on the lists on page 6 of Exhibit 1 to CASE's memorandum. Initially, it is important to note that CASE's list includes five-line travelers and eight-line travelers. With respect to the five-line travelers, for example weld 6, the fifth line is for the final V.T. inspection, not for a fit-up and cleanliness inspection. Thus, CASE's allegations for the five-line travelers does not make any sense. In any event,

where the fifth line of the five-line traveler is unsigned, it simply means that weld is in process, and it does not reflect any paper or technical deficiency.

The eight-line travelers on the list fall into several categories. First, many of the travelers are for welds that are welded on one side only (welds 875, 896, 901, 908, 909, 910, 912, 682, 713, 714, 779, 783, 784, 785, 797, 798, and 799). For these welds CASE's allegation is wrong because there is welding on only one side of the liner; consequently, there are no fit-up or cleanliness inspections to be performed on the second side of the liner. Second, CASE is correct with respect to a small group of eight-line travelers (welds 12, 51, 59, 65,66, 72, 73, 90, 93, 107, 147, 203, 709, 851, and 907), and I have directed that an NCR be written identifying the welds for which the inside fit-up and cleanliness inspections have not been documented. Finally, my examination of all of the remaining eight-line travelers on CASE's list reveals that CASE is factually wrong because the inside fit-up and cleanliness inspections were performed and documented.

Q17. On pages 7-8 of Exhibit 1, CASE lists twenty-seven (27) welds which CASE contends are missing the final V.T. of the inside weld. Have you reviewed this allegation?

A17. Yes.

Q18. What conclusions have you drawn as a result of that review?

A18. This is another example of CASE's lack of understanding of the fabrication and inspection process. CASE is correct in noting that a final visual inspection has not been performed for these welds, but the final visual inspection has not been performed because the welding/inspection process has not been completed. My review of the travelers indicates that no holdpoints have been bypassed and no violation exists for any of these welds.

Q19. Mr. Brandt, CASE also lists twenty-two (22) welds on page 8 for which WFMLs are not in the package. Have you had an opportunity to review this allegation?

A19. Yes. However, the absence of WFMLs in these traveler packages does not constitute a violation of procedure or a deficiency. There is simply no requirement specifying that a copy of the applicable WFML is to be kept in each traveler. I might also add, there is no requirement for filler metal traceability on any of these welds.

Q20. On pages 9-15 of Exhibit 1, CASE alleges that WFMLs are referenced on travelers indicating that new welding was done, but there is no QC verification or involvement when the welding is done. Assuming this to be true, what significance does this allegation have?

A20. Although I have not reviewed all the travelers listed by CASE on pages 9-15, I have reviewed enough to lead me to believe that this is another instance where CASE does not understand the requirements and/or the fabrication sequence. In all travelers I reviewed, no inspection hold-

points have been bypassed. If CASE is attempting to infer that QC must perform some type of "verification" each day welding is performed, this simply is not the case. All required inspections are procedurally described, and there is no requirement for "verification" each day welding is performed. From the sample I reviewed, I am unable to detect any violation.

Q21. Mr. Brandt, turning your attention to pages 16-20 of Exhibit 1, CASE lists numerous welds for which welding was done, but no QC verification or involvement is shown, and that WFMLs are attached to, but not references on, the travelers. What significance, if any, is there to this allegation.

A21. None. Once again, as I discussed above, this is apparently another instance where CASE is attempting to assert that verification of welding must be performed on each day that welding occurs. Of the travelers that I reviewed in connection with this allegation, all welds were still in-process, i.e., they had not yet received final inspection. CASE's observation that WFMLs are attached to, but not referenced on, the travelers is correct; however, the allegation is without significance. This information is not required by specification, and serves no quality function. The millwrights are procedurally required to enter this information but they simply have not done so as of this date.

Q22. Mr. Brandt, CASE identifies 5 NCRs on page 21 of Exhibit 1 which describe welds for which vacuum box testing was improperly noted as not applicable. Is there significance to this observation?

A22. No. It was an error made by the inspector, but was properly reported and dispositioned on an NCR.

Q23. On page 22, CASE lists fifty-seven (57) welds which it alleges are deficient because final V.T. has been performed without vacuum box and/or liquid penetrant examination being performed. Have you reviewed this allegation?

A23. Yes, I have.

Q24. What was the result of your review?

A24. CASE apparently misunderstands the inspection testing sequence. The final V.T. precedes the vacuum box testing and the liquid penetrant examination. As these welds are clearly still in process, no holdpoints have been bypassed and no violation exists.

Q25. On the bottom of page 22, CASE notes "the final V.T. of the inside welds were signed off on the following welds by other inspectors." What is the significance, if any, of this observation?

A25. I am not quite sure to whom CASE is referring by the use of the phrase "other inspectors." I assume CASE is referring to the fact that the final V.T. has been performed by inspectors other than those who performed the P.T. and/or V.B. test. If this is CASE's allegation, it is without

merit because there is no requirement that the same inspector perform V.T. and P.T. and/or vacuum box testing. No violation exists.

Q26. Mr. Brandt, on page 23 of Exhibit 1, CASE lists 131 welds which it alleges are deficient because the "completion of weld inspection block on attachment 1 signed off as completed prior to the completion on welds prior to [sic] vacuum box testing and/or P.T. inspection being performed." Have you reviewed this allegation?

A26. Yes, I have.

Q27. What did your review indicate?

A27. The welds listed fall into several different categories. For a number of welds which CASE asserts that "completion of weld inspection block on attachment 1 signed off as completed prior to the completion on welds prior to [sic] vacuum box testing and/or P.T. inspection being performed," CASE is incorrect as the travelers clearly indicate that the weld is still in process. Welds 5, 7, and 8 are examples of this category. As the welds are incomplete, no violation exists. For a small group of welds, (weld numbers 1240, 1242, 1245, 1248, 1182, 1209, and 1210), CASE is correct and I have directed that an NCR be written identifying the condition as nonconforming. For all other welds listed on page 23, CASE is incorrect because the referenced tests are not required; therefore, no violation exists.

Q28. CASE alleges on page twenty-four of Exhibit 1 that "[m]any NCR's were written for welds that James Cole had N/A'd the vacuum box test on. The vacuum box test has been reestablished on all but the ones below." Have you had an opportunity to review this allegation and the travelers involved with this allegation?

A28. Yes, I have.

Q29. What was the result of your review?

A29. Apparently CASE alleges that vacuum box was required for these welds. CASE lists eighty-eight (88) welds which it believe are deficient. As a result of my review, I have determined that with one excpetion (weld 932) that CASE's allegation is incorrect. All other wleds are not pressure boundary welds and therefore do not require vacuum box testing, and the step is properly marked not applicable ("N/A") on the traveler. I have directed that an NCR be written for weld 932 noting that the vacuum box test for that weld was improperly marked "N/A."

Q30. Mr. Brandt, CASE alleges on the bottom of page twenty-four of Exhibit 1, that "PT test has been performed on these welds but vacuum box has not". Have you had an opportunity to review this allegation and the related travelers.

A30. Yes I have.

Q31. What were the result of your review of these travelers?

A31. CASE lists an additional forty-eight (48) welds for which vacuum box has not been performed. For four (4) of these welds (welds 1230, 1232, 1235, and 1238), CASE is correct

and I have directed that an NCR be prepared describing this condition. For all other welds listed here, CASE is incorrect; the step has properly been marked not applicable as these welds do not require vacuum box testing.

Q32. Mr. Brandt, directing your attention to page twenty-five of Exhibit 1, in particular to CASE's discussion of NCR M-83-01847 dated 7/7/83. CASE states that "The NCR was written in 1983 and a hold tag applied. It has not been dispositioned yet, and there is no copy of this NCR in traveler 151. There is no RPS in package for weld 154. 154 was signed off by Don Vogt, S.M. McCoy, for steps 2, 3, and 4. Jim Cole inspected 151 on 4/20/80 and 153 on 4/24/80." What is the significance, if any, of these allegations?

A32. First, CASE is incorrect in stating that "...it has not been dispositioned yet." In fact, CASE describes the disposition of this NCR on page 25 of Exhibit 1. Second, original NCRs are not filed with traveler packages, nor does the lack of a copy of the NCR in package 151 constitute a violation of any code, standard, specification, or procedure. Third, CASE's observation that no RPS is in package 154 is correct, but it is without significance for two reasons: first, the repair is not yet complete, and second, the repair, when completed, will be of weld 151, not weld 154, and accordingly a copy of the RPS will be in package 151, not 154. Fourth, with respect to CASE's observation that "Jim Cole inspected weld 151 on 4/20/80, [actually 4/2/80] and 153 on 4/24/80," CASE is apparently

speculating on Mr. Cole's ability as an inspector. There is no indication that weld 153 was improperly inspected. The NCR clearly states that the backing bar had been ground through. No evidence exists which indicates that the backing bar was not intact when Mr. Cole performed his inspection on 4/24/80, and, as CASE notes, the incident (grinding through the backing bar) was properly reported as nonforming. In the other incident described, i.e., the failure of the backing bar to continue for the full length of the weld at the intersection of welds 166 and 153, CASE again seems to allege that this weld was improperly inspected by Mr. Cole. Although not extremely clear from the face of the document, what Mr. Halcomb, the originator of the NCR, was attempting to indicate by attaching the Chit for first fit-up of weld 154, was that the "deficient" backing strip was from weld 154, not from weld 151. Therefore, Mr. Cole clearly was not involved with this deficiency. The deficient condition becomes clearer after looking at the drawing. Weld 151 is a vertical weld which attaches a plate (A35) to a gate guide. Although the vertical weld continues on down the gate guide, it is numbered differently for each plate it attaches. Welds 151, 155, 157, and 159 all form the vertical weld which attaches a gate guide to plates A35, B35, M35 and M35, respectively. This weld (although 4 weld numbers) was fit up on 5/17/79. The backing strip for this weld (weld numbers 151, 155, 157, and 159) was continuous for the length of the weld. The fact

that the backing strip for weld 154 lacked 3/8" from running the full length of the weld was properly reported on an NCR, and is attributable to inspector error.

Q33. On page 26 of Exhibit 1, CASE refers to a numbering discrepancy which was reported on NCR M-83-00907. What significance, if any, is there for this allegation?

A33. This allegation is correct, however without significance. In this case the construction group which issued the travelers, assigned separate weld numbers for the welds attaching the backing strip and leak chase to the gate guide. Although clearly indicated on the traveler, the millwrights were not timely in assignment of these weld numbers to the marked-up drawing which they were procedurally required to maintain. This condition was properly identified by QC on an NCR and the situation was corrected. In no way was this an inspection deficiency.

Q34. Mr. Brandt, on page 27 of Exhibit 1, CASE identifies two nonconformance reports, NCR M84-01969 and NCR M84-00498. Have you had a chance to review CASE's allegation regarding these NCRs?

A34. Quite frankly, I am unable to find that CASE alleges anything with regard to these two NCRs. Both identified problems, and both were properly dispositioned in accordance with site procedures. CASE's note regarding the absence of a copy of the NCR in all of the packages is not a violation of any requirement. As I stated earlier, the original NCR is filed in a location separate from the

traveler package. All packages do contain the corrected PT report and reference NCR M-84-00948. Other than the deficiency which was reported on these two NCRs, I am not aware of any deficiency in the way they were processed or dispositioned.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
TEXAS UTILITIES ELECTRIC COMPANY, et al.	)	Docket Nos. 50-445-2 and 50-446-2
	)	
(Comanche Peak Steam Electric Station, Units 1 and 2)	)	(Application for Operating Licenses)

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing "Prefiled Testimony of C. Thomas Brandt Regarding CASE's Further 'Evidence' of a Quality Control Breakdown in the Construction, Installation and Inspection of the Stainless Steel Liner Plate" in the above-captioned matter were served upon the following persons by hand-delivery or deposit in the United States mail,* first class, postage prepaid, this 20th day of November, 1984:

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Brown & Root, Inc. HOUSTON, TEXAS

WELD PROCEDURE NO. 88023
REVISION 4
PAGE 1 OF 2

APPLICABLE CODE(S)	WELD PROCEDURE SPECIFICATION COMANCHE PEAK STEAM ELECTRIC STATION	SUPPORTING PQR(S)
ASME Sec. IX ASME Sec. III ANSI B31.1		0808AA204 Rev. 3 0808AB106 Rev.4 0808AA114 Rev.1

BASE METAL

P NO. 8 GROUP 1 TO P NO. 8 GROUP 1
THICKNESS RANGE 0.065" through 0.750"
DIAMETER RANGE Unlimited

JOINT PREPARATION

Weld ends may be prepared by machining, plasma arc cutting, and/or grinding.

PROCESS(ES)

Gas Tungsten Arc

CLEANING (INITIAL & INTERPASS)

Welding surfaces shall be wire brushed or ground as required to remove slag, scale, or other contaminants.

POSITION

All Positions
PROGRESSION Upward

GAS

SHIELDING Argon FLOW RATE 15 CFH Min.
PURGE Argon (1) FLOW RATE 5 CFH Min.
TRAILING N/A FLOW RATE N/A

FILLER METAL

PROCESS GTAW SFA NO. 5.9 F NO. 6 A NO. 3
PROCESS N/A SFA NO. N/A F NO. N/A A NO. N/A
OTHER N/A

FLUX

CLASSIFICATION N/A
PARTICLE SIZE N/A
TRADE NAME N/A

VOID

CPSES DOCUMENT CONTROL CENTER COPY

PREHEAT

PREHEAT TEMP., °F 60°F
INTERPASS RANGE, °F 60°F - 350°

POST WELD HEAT TREATMENT

TYPE None
TEMPERATURE N/A
TIME N/A

ADDITIONAL OR SUPPLEMENTARY REQUIREMENTS

1. Prior to the start of welding, the exiting gas from the purge area shall be checked for its oxygen content. Oxygen content of the exiting gas must be 2% or below before welding can commence. The purge shall be maintained for at least two (2) passes (i.e., Root and one Fill).

2. All weld joints shall be free of moisture, oxide, grease, oil and protective coatings. All slag and/or surface defects shall be removed as prescribed from each weld bead prior to the continuation of welding.

(1) Purge requirement shall be deleted when backing strip is utilized.

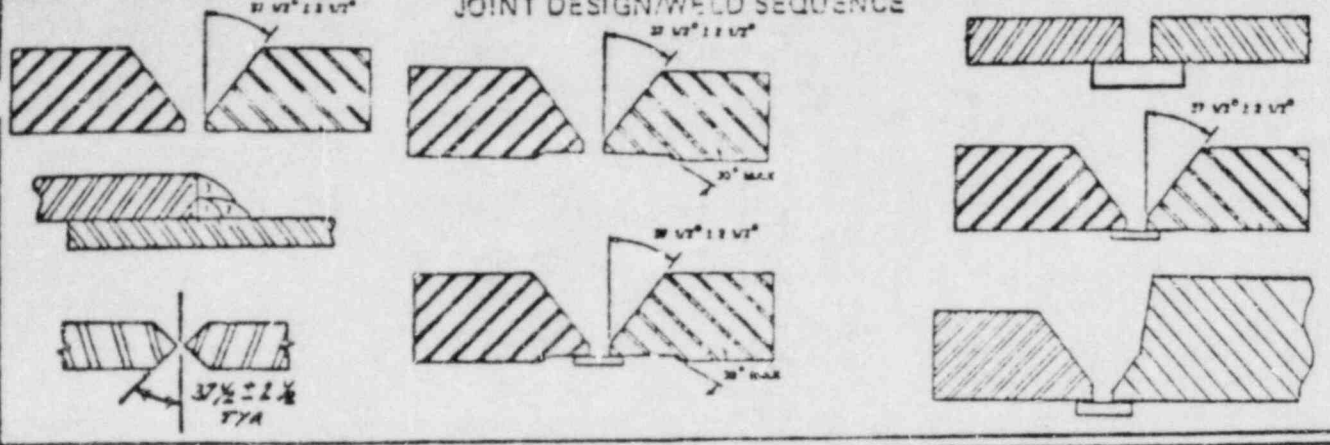
PREPARATION APPROVAL	DATE	ISSUE DATE	September 20, 1978
[signature]	9-20-78	NSSS SUPPLIER	N/A
WELDING ENGINEERING		ENGINEER	Approval GHF 3250 10-6-78
[signature]	9-20-78	PROJECT NO.	CR-0172
MATERIALS ENGINEERING			
[signature]	9-20-78		
QUALITY ASSURANCE			

ATTACHMENT 1

P NO. 8 GROUP 1 TO P NO. 8 GROUP 1
THICKNESS RANGE 0.0625" TO 0.750"

88023
REVISION 4
PAGE 2 OF 2

JOINT DESIGN/WELD SEQUENCE



WELD PARAMETERS

PASS	PROCESS	FILLER METAL SIZE	FILLER METAL CLASS	GAS/FLUX TYPE	GAS/FLUX Min. FLOW	ELECTRICAL DATA TYPE	ELECTRICAL DATA AMPERAGE	ELECTRICAL DATA VOLTS	TRAVEL IPM	MAX. BEAD WIDTH
1	GTA	1/16"	See Note 7	Argon	15 CFH	DCSP	100 Max.	11 Max.	-	3/8"
		or								
	GTA	3/32"	See Note 7	Argon	15 CFH	DCSP	100 Max.	11 Max.	-	3/8"
2-3	GTA	1/16"	See Note 7	Argon	15 CFH	DCSP	115 Max.	11 Max.	-	3/8"
		or								
	GTA	3/32"	See Note 7	Argon	15 CFH	DCSP	115 Max.	11 Max.	-	3/8"
4&ON	GTA	3/32"	See Note 7	Argon	15 CFH	DCSP	140 Max.	11 Max	-	3/8"
		or								
	GTA	1/8"	See Note 7	Argon	15 CFH	DCSP	140 Max.	11 Max	-	3/8"

PREHEAT	60°F	BACK GOUGING METHOD	N/A
INTERPASS TEMP.	60°F - 350°F	CONTACT TUBE TO WORK (IN.)	N/A
SINGLE OR MULTIPLE ARC	Single	ORIFICE OR CUP SIZE	3/8" Min
SINGLE OR MULTIPLE PASS	Multiple	WELD PROGRESSION	Upward

SPECIAL INSTRUCTIONS

1. Preheat shall be established prior to the start of welding.
2. The interpass temperature (above 150°F) shall be checked using temperature indicating crayons or an approved equal.
3. The number of weld beads may vary with section thickness.
4. The starts and stops of all tack welds shall be tapered by grinding so that the initial pass can be properly consume the tack.
5. Tack welds which are used at the root of joints shall be complete penetration.
6. The non-consumable electrode for the Gas Tungsten Arc process shall conform to AWS A5.12 Class EWTh-1 (1% Thoriated Tungsten) or Class EWTh-1 (2% Thoriated Tungsten).
7. The type of bare wire selected for the base metal to be welded shall be as follows:

BASE METAL TYPE	BARE WIRE TO BE USED
304 or 304L to 304 or 304L	ER308 or ER308L
316 or 316L to 316 or 316L	ER316 or ER316L
304 or 304L to 316 or 316L	ER316 or ER316L

Brown & Root, Inc. HOUSTON, TEXAS

PQR No. 0808AA204 Rev. 3

PROCEDURE QUALIFICATION RECORD

Material Spec. SA-312 TP304 to SA-312 TP304

P No. 8 Gr. No. 1 to P No. 8 Gr. No. 1 Thickness and O.D. .280" Wall Thickness x 6.0"Dia.

Welding Processes	1. Gas Tungsten Arc	2. N/A
Manual or Automatic	1. Manual	2. N/A
Thickness Range	1. -	2. N/A

Total Qualified Thickness Range 0.0625" thru .550"

FILLER METAL

F-No.	1. 6	2. N/A
A-No.	1. 8	2. N/A
SFA Spec.	1. 5.9	2. N/A
AWS Class.	1. ER308	2. N/A
Filler Size	1. 3/32"	2. N/A
Trade Name	1. ARCOS	
	2. N/A	

Describe Filler Metal if not included in Section IX
1/8" x 5/32" Arcos Consumable Insert

FLUX OR ATMOSPHERE

Trade Name	1. -	2. N/A
Shielding Gas	1. Argon	2. N/A
Flow Rate	1. 16CFH Min.	2. N/A
Purge	1. 16CFH Min.	2. N/A

WELDING PARAMETERS

Joint Type	Single Vee Groove Weld	
Position	6G Upward	
Backing	Consumbale Insert (Tyne K)	
Preheat	60°F	
IPT Range	60°F - 350°F	
PWHT	None	
Passes/Side	1. Multiple	2. N/A
No. of Arcs	1. Single	2. N/A
Current	1. DCSP	2. N/A
Amps	1. 70-100	2. N/A
Volts	1. 8-10	2. N/A
Travel Speed	1. 1"-2" IPM	2. N/A
Oscillation	1. 3/8" Max.	2. N/A
Bead Type	1. Stringer	2. N/A

TENSILE TEST

Specimen No.	Dimensions Width	Dimensions Thickness	Area	Ultimate Total Load Lb.	Ultimate Unit Stress psi	Character of Failure And Location
QW-462.1(b)#1	0.724	0.208	.1506	13,100	87,000	Weld
QW-462.1(b)#2	0.719	0.205	.1474	13,300	90,200	Weld

GUIDED BEND TESTS

Type and Figure No.	Result	Type and Figure No.	Result
QW-462.3(a) Face	Satisfactory	QW-462.3(a) Root	Satisfactory
QW-462.3(a) Face	Satisfactory	QW-462.3(a) Root	Satisfactory

Welder's Name Jimmy E. Hite Clock No. 2314 Stamp No. AAC

Who by virtue of these tests meets welder performance requirements. Laboratory Test No. 29559-60

Test Conducted by Southwestern Laboratories Address Houston, Texas

per Mr. Don Sprow Date 2-20-76

We certify that the statements in this record are correct and that the test welds prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Signed BROWN & ROOT, INC.
(Manufacturer)

Date 3-7-78 By [signature]

Brown & Root, Inc. HOUSTON, TEXAS | PQR No. 0808AA204 Rev. 3

SUPPLEMENTAL TESTS | Page 2 of 4

TOUGHNESS TEST TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

FILLET WELD TEST FIG _____

MACRO TEST RESULTS	FRACTURE TEST RESULTS

CHEMICAL ANALYSIS % METHOD Wet Chemical PER ASTM E350-74

ELEM.	C	Mn	P	S	Si	Cr	Ni	Mo	Cu	Ti	N	Cb				Fe
WELD	.033	1.76			.42	19.89	9.45	.29			.059	0.0				
	Approximate Delta Ferrite Content: 9% (Schaeffler Diagram per Figure 2433-1 of the ASME Section III Code)															

ADDITIONAL TESTS

Delta-ferrite tests were conducted on the completed weld at 12:00, 3:00, 6:00, and 9:00 o'clock with a severn ferrite indicator. All positions recorded a 7.5 to 10% delta-ferrite content.

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 0808AA204 Rev. 3 and the requirements of N/A.

Signed BROWN & ROOT, INC.

Date 3-7-78

By R. A. Freeman

Brown & Root, Inc. HOUSTON, TEXAS	PQR No. 0808AA204 Rev. 3
SUPPLEMENTAL TESTS	Page 3 of 4

TOUGHNESS TEST TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

FILLET WELD TEST FIG _____

MACRO TEST RESULTS	FRACTURE TEST RESULTS

CHEMICAL ANALYSIS % METHOD _____ PER _____

ELEM.	C	Mn	P	S	Si	Cr	Ni	Mo	Cu	Ti							Fe
WELD																	
BASE																	

ADDITIONAL TESTS

Bend tests were examined at 10X magnification after bending to meet the acceptance criteria of "Interm Regulatory Guide 1.31." No fissures exceeding 1/64" were present.

Radiographic Report of Welder Qualification: Radiographic report WQRT 00009, was run in accordance with Section IX, 1974, Paragraph QW-142. The acceptance criteria of Section VIII, Division 1 was herein met.

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 0808AA204 Rev. 3 and the requirements of N/A.

Signed BROWN & ROOT, INC.

Date 3-7-78

By _____

Brown & Root, Inc. HOUSTON, TEXAS	PQR No. 0808AA204 Rev. 3
SUPPLEMENTAL TESTS	Page 4 of 4

TOUGHNESS TEST · TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

Two (2) specimens were sensitization tested in accordance with ASMT A262-70, Practice E. Specimens were examined at 20X magnification for presence of microcracking. No fissures were present.

The following parameter excerpts have been extracted from the actual parameters utilized within qualification of said procedure and are calculated to asseverate that the maximum energy input range during qualification is within that prescribed by the PSAR.

ADDITIONAL TESTS

		ENERGY INPUT RANGE
GTAW Process		
Amperage	80	90
Voltage	10	8
Travel Speed (in. per/min.)	2.0	1.0
Kilojoules/inch	24.000 min.	43.200 max.

Note: Parameters noted are indicative of the maximum and minimum energy input range and do not necessarily reflect the maximum/minimum amperage/voltage utilized during qualification

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 0808AA204 Rev. 3 and the requirements of N/A.

Signed BROWN & ROOT, INC.

Date 3-7-78

By _____

Brown & Root, Inc. HOUSTON, TEXAS

PQR No. 0808AB106 Rev. 4

PROCEDURE QUALIFICATION RECORD

Material Spec. SA-312 TP 304 to SA-312 TP 304
P No. 8 Gr. No. 1 to P No. 8 Gr. No. 1 Thickness and O.D. 0.269" Wall Thickness x 6.0"I
Welding Processes 1. Gas Tungsten Arc 2. Shielded Metal Arc
Manual or Automatic 1. Manual 2. Manual
Thickness Range 1. - 2. -
Total Qualified Thickness Range 0.0625" thru 0.550"

FILLER METAL

F-No.	1. 6	2. 5
A-No.	1. 8	2. 8
SFA Spec.	1. 5.9	2. 5.4
AWS Class.	1. ER308	2. E308-16
Filler Size	1. 3/32"	2. 3/32"&1/8"
Trade Name	1. Arcos	
	2. Arcos	

Describe Filler Metal if not included in Section IX
N/A

FLUX OR ATMOSPHERE

Trade Name	1. -	2. N/A
Shielding Gas	1. Argon	2. N/A
Flow Rate	1. 15 CFH Min.	2. N/A
Purge	1. 10 CFH Min.	2. N/A

WELDING PARAMETERS

Joint Type	Single Vee Groove Weld	
Position	6G Upward	
Backing	None	
Preheat	60°F	
IPT Range	60°F-350°F	
PWHT	None	
Passes/Side	1. Multiple	2. Multiple
No. of Arcs	1. Single	2. Single
Current	1. DCSP	2. DCRP
Amps	1. 89-95	2. 70-95
Volts	1. 8-10	2. 16-22
Travel Speed	1. 3-4 IPM	2. 2.5-5.0 IPM
Oscillation	1. 5/16" Max.	2. 5/16" Max.
Bead Type	1. Stringer	2. Stringer

TENSILE TEST

Specimen No.	Dimensions Width	Dimensions Thickness	Area	Ultimate Total Load Lb.	Ultimate Unit Stress psi	Character of Failure And Location
QW-462.1(b) #1	.732	.146	.1069	9,750	91,200	Weld
QW-462.1(b) #4	.733	.156	.1143	10,100	88,400	Weld

GUIDED BEND TESTS

Type and Figure No.	Result	Type and Figure No.	Result
QW-462.3(a) Face	Satisfactory	QW-462.3(a) Root	Satisfactory
QW-462.3(a) Face	Satisfactory	QW-462.3(a) Root	Satisfactory

Welder's Name Jimmy Hite Clock No. 2314 Stamp No. AAC
Who by virtue of these tests meets welder performance requirements. Laboratory Test No. 17928
Test Conducted by Southwestern Laboratories Address 222 Cavalcade, Houston, TX
per Henry Habenicht Date May 6, 1976

We certify that the statements in this record are correct and that the test welds prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Signed Brown & Root, Inc.
(Manufacturer)

Date 9-20-78 By T. J. Patarapi

Brown & Root, Inc. HOUSTON, TEXAS	PQR No 0808AB106 Rev. 4
SUPPLEMENTAL TESTS	Page 2 of 3

TOUGHNESS TEST TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

FILLET WELD TEST FIG _____

MACRO TEST RESULTS	FRACTURE TEST RESULTS

CHEMICAL ANALYSIS % METHOD Wet Chemical PER ASTM E350-74

ELEM.	C	Mn	P	S	Si	Cr	Ni	Mo	Cu	Ti	N	Cb				Fe
WELD	.079	1.59			.70	19.79	9.13	.29			.060	0.0				
BASE	Approximate Delta Ferrite Content: 7% (Schaeffler Diagram per Figure 2433-1 of the ASME Section III Code).															

ADDITIONAL TESTS

Bend tests were examined at 10X magnification after bending to meet the acceptance criteria of "Interim Regulatory Guide 1.31." No fissures were present.

Radiographic Report of Welder Qualification: Radiographic report WQRT 00030 was run in accordance with Section IX, 1974, Paragraph QW-142. The acceptance criteria of Section VIII, Division I was herein met.

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 0808AB106 Rev. 4 and the requirements of N/A.

Signed Brown & Root, Inc.

Date 9-20-78

By T. J. Pastargi

Brown & Root, Inc. HOUSTON, TEXAS | PQR No. 0808AA114 Rev.1

SUPPLEMENTAL TESTS | Page 2 of 3

TOUGHNESS TEST TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

FILLET WELD TEST FIG _____

MACRO TEST RESULTS	FRACTURE TEST RESULTS

CHEMICAL ANALYSIS % METHOD Wet Chemical PER ASTM E350-74

ELEM.	C	Mn	Si	Ni	Mo	Cr	N	Cb	
WELD	.013	1.61	.35	9.38	.07	19.96	.0586	<.01	
	Approximate Delta Ferrite Content: 10% (Schaeffler Diagram per Figure 2433-1 of the ASME Section III Code)								

ADDITIONAL TESTS

1. Bend tests were examined at 10X magnification after bending to meet the acceptance criteria of "Interim Regulatory Guide 1.31." No fissures were present.
2. Delta-Ferrite tests were conducted at twelve (12) points (six per side), along the length of the procedure qualificationcoupon. Ferritescope MTE/726 was used and the following results noted:

Position	Delta-Ferrite Number
All	All positions ranged between 9.5 and 11.5

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 0808AA114 Rev. 1 and the requirements of N/A.

Signed Brown & Root, Inc.

Date 9-20-78

By T. J. Dalangin

Brown & Root, Inc. HOUSTON, TEXAS	PQR No. 080SAA114 Rev.1
SUPPLEMENTAL TESTS	Page 3 of 3

TOUGHNESS TEST TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

FILLET WELD TEST FIG _____

MACRO TEST RESULTS	FRACTURE TEST RESULTS

ADDITIONAL TESTS

1. Two (2) specimens were sensitization tested in accordance with ASTM A262-70, Practice E. Specimens were examined at 20X magnification for presence of microcracking. No fissures were present. In addition, Westinghouse Document WCAP - 8678 states that energy input of 80 KJ/inch for base metal thickness of 3/4" resulted in no sensitization of the base metal.

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 080SAA114 Rev. 1 and the requirements of N/A.

Signed Brown & Root, Inc.

Date 9-20-78

By T. J. Poskanzer

Brown & Root, Inc. HOUSTON, TEXAS	PQR No. 0808AB106 Rev. 4
SUPPLEMENTAL TESTS	Page 3 of 3

TOUGHNESS TEST TYPE _____ PER _____
SIZE _____ PER _____

SPECIMEN IDENTIFICATION	TEST TEMP	NOTCH LOCATION	ENERGY FT-LBS	MILS LAT. EXP	% SHEAR	DROP WEIGHT BREAK	DROP WEIGHT NO BREAK

HARDNESS TEST TYPE _____ PER _____

NO.	WELD METAL	HEAT AFFECTED ZONE	BASE METAL

FILLET WELD TEST FIG _____

MACRO TEST RESULTS	FRACTURE TEST RESULTS

ADDITIONAL TESTS

1. Delta Ferrite tests were conducted on the completed weld test pad at six equidistant locations at the centerline with a severn ferrite indicator. All positions recorded the following delta-ferrite content:

   Greater than 7.5, less than 10%.

2. Two (2) specimens were sensitization tested in accordance with ASTM A262-70, Practice E. Specimens were examined at 20X magnification for presence of microcracking. No fissures were present. In addition, Westinghouse document WCAP-8678 states that energy input of 80 KJ/inch for base metal thickness of 3/4" resulted in no sensitization of the base metal.

We certify that the statements in this record are correct and that the tests were conducted in accordance with PQR No. 0808AB106 Rev. 4 and the requirements of N/A.

Signed Brown & Root, Inc.

Date 9-20-78

By T. T. Tarazi

Brown & Root, Inc. HOUSTON, TEXAS	PQR No. 0808AA114 Rev. 1
PROCEDURE QUALIFICATION RECORD	Page 1 of 3

Material Spec. SA-240 Type 304L to SA-240 Type 304L

P No. 8 Gr. No. 1 to P No. 8 Gr. No. 1 Thickness and O.D. 1-3/4" plate

Welding Processes	1. Gas Tungsten Arc	2. N/A	
Manual or Automatic	1. Manual	2. N/A	
Thickness Range	1. -	2. N/A	
Total Qualified Thickness Range	0.1875" thru 3.500"		

FILLER METAL

F-No.	1. 6	2. N/A
A-No.	1. 8	2. N/A
SFA Spec.	1. 5.9	2. N/A
AWS Class.	1. ER308 & 308L	2. N/A
Filler Size	1. 3/32" & 1/8"	2. N/A
Trade Name	1. 3/32" Arcos; 1/8" Sandvik	
	2. N/A	

Describe Filler Metal if not included in Section IX

FLUX OR ATMOSPHERE

Trade Name	1. -	2. N/A
Shielding Gas	1. Argon	2. N/A
Flow Rate	1. 20 CFH Min.	2. N/A
Purge	1. 20 CFH Min.	2. N/A

WELDING PARAMETERS

Joint Type	Double Vee Groove Weld	
Position	2G	
Backing	None	
Preheat	60°F	
IPT Range	110°F through 350°F	
PWHT	None	
Passes/Side	1. Multiple	2. N/A
No. of Arcs	1. Single	2. N/A
Current	1. DCSP	2. N/A
Amps	1. 100-130	2. N/A
Volts	1. 11	2. N/A
Travel Speed	1. 2.1-4.0 IPM	2. N/A
Oscillation	1. 3/8" Max.	2. N/A
Bead Type	1. Stringer	2. N/A

TENSILE TEST

Specimen No.	Dimensions Width	Dimensions Thickness	Area	Ultimate Total Load Lb.	Ultimate Unit Stress psi	Character of Failure And Location
QW-462.1(a) #1	1.002	1.614	1.617	144,700	89,487	Weld Metal
QW-462.1(a) #2	1.005	1.491	1.498	134,000	89,453	Weld Metal

GUIDED BEND TESTS

Type and Figure No.	Result	Type and Figure No.	Result
QW-462.2(a) Side	Satisfactory	QW-462.2(a) Side	Satisfactory
QW-462.2(a) Side	Satisfactory	QW-462.2(a) Side	Satisfactory

Welder's Name Curtis Marquis S.S.No. 260-64-7775 Stamp No. AAJ

Who by virtue of these tests meets welder performance requirements. Laboratory Test No.

Test Conducted by Materials Engineering Lab. Address 3100 Clinton Dr., Houston, Texas

per G. E. Dawson Date March 9, 1978

We certify that the statements in this record are correct and that the test welds prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Signed Brown & Root, Inc.
(Manufacturer)

Date 9-20-78 By T. J. Tortorigian

Brown & Root, Inc. HOUSTON, TEXAS

WELDING PROCEDURE NO
WPS - 88025
REVISION 3
PAGE 1 OF 2

WELDING CODE: ASME B & PV SECTION IX

WELDING PROCEDURE SPECIFICATION

SUPPORTING PQR(S): *0808AA114 Rev.3

WELDING PROCESS(ES) 1. Gas Tungsten Arc TYPE Manual
2. N/A TYPE N/A

BASE METALS (QW-403)
P No. 8 Gr. No. 1 to P No. 8 Gr. No. 1
Thickness Range .187 thru 3.50 IN.
Pipe Dia. Range Unlimited IN.
Range for Fillet Thk All Dia. Unlimited IN.

POSTWELD HEAT TREATMENT (QW-407)
Type N/A
Temperature N/A °F
Time Range N/A

FILLER METALS (QW-404)
F No. 1. 6 2. N/A
A No. 1. 8 2. N/A
SFA Spec. No. 1. 5.9 2. N/A
AWS Class. No. 1. ER3XX 2. N/A
Size of Electrode 1. N/A 2. N/A IN.
Size of Filler 1. 3/32, 1/8 2. N/A IN.
Electrode - Flux Class N/A
Consumable insert N/A

GAS (QW-408)
Shielding Gas 1 Argon
Percent Comp. 100
Shielding Gas Flow Rate 15 CFH (min.)
Purge Gas Argon (6) Flow Rate 5 CFH (min.)
Trailing Shielding Gas Composition N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current 1. DCSP 2. N/A
Amps Range 1. 50-150 2. N/A
Volts Range 1. 8-14 2. N/A
Tungsten Elec. Size/Type 1/16"-1/8"/EnTh-1 or 2

POSITION (QW-405)
Welding Position All
Welding Progression Upward

TECHNIQUE (QW-410)
Stringer or Weave Bead 1. Stringer 2. N/A
Bead Width: See Page 2
Orifice or Gas Cup Size 1/4 - 1/2 IN.
Initial and Interpass cleaning: Welding surfaces shall be wire brushed or ground as required to remove slag, scale or other contaminants.
Method of back gouging N/A

PREHEAT (QW-406)
Preheat Temp. 60 °F (Min.)
Interpass - Temp. Range 60-350 °F
Preheat Maint. 60 °F

JOINT DESIGN (QW-402)
Groove Design Single V or U
Joint Type OB Yes CI N/A BS Yes
Backing Matl Type Similar to base material

Oscillation 1. N/A 2. N/A IN.
Contact Tube to work distance N/A IN.
Multiple or Single Layer 1. Multiple
(Per Side) 2. N/A
Multiple or single electrodes Single
Travel Speed (Range) 1. N/A 2. N/A IPM
Peening: Not allowed

REMARKS *This PQR includes Supplemental Test Results.

Prior to the start of welding, the exiting gas shall be checked for oxygen content. It must be 2% or lower before welding can commence. Maintain purge for at least two layers (i.e., root and one fill). Westinghouse supplied components require purge maintenance for at least three layers (i.e., root and two fills)

PREPARATION/APPROVAL
Welding Engineering — DATE 10-12-79
Materials Engineering — 10.12.79
Quality Assurance — 10-15-79

Fab. Codes: ASME Section III, ANSI B31.1
Project: CPSES
Job No. CR-0172

ATTACHMENT 2

WELDING TECHNIQUE SHEET

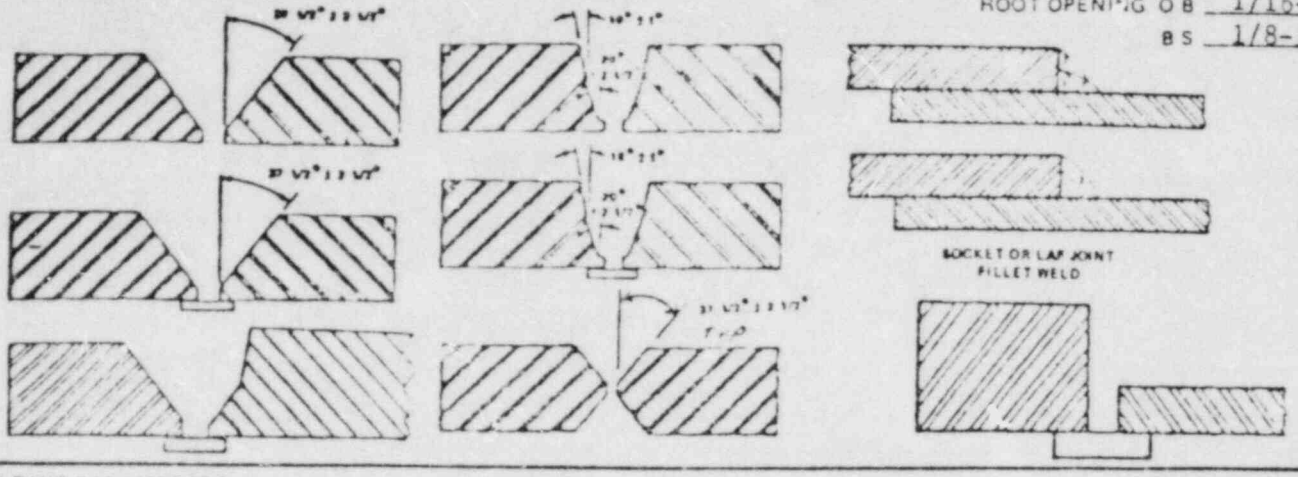
P NO. 8 GROUP 1 TO P NO. 8 GROUP 1

THK. RANGE .187 thru 3.50 IN.

WELDING PROCEDURE NO.
WPS 88025
REVISION 3
PAGE 2 OF 2

TYPICAL JOINT DESIGNS PERMITTED

ROOT OPENING OB 1/16-3/16 IN
BS 1/8-1/4 IN



WELDING PARAMETERS

*SINGLE VALUES ARE MINIMUM

LAYER	WELDING PROCESS	FILLER METAL SIZE (IN.)	FILLER METAL AWS CLASS	GAS TYPE	GAS FLOW RATE* (CFH) SHIELD	GAS FLOW RATE* (CFH) PURGE	ELECTRICAL DATA TYPE/ POLAR	ELECTRICAL DATA AMPERAGE RANGE	ELECTRICAL DATA VOLTS RANGE	TRAVEL SPEED (IPM)	MAX BEAD WIDTH (IN.)
1-3	GTA or	3/32	See Note 5	Argon	15	5	DCSP	50-150	8-14	N/A	3/8
	GTA	1/8	See Note 5	Argon	15	5	DCSP	50-150	8-14	N/A	3/8
Alt. 3 & on	GTA or	3/32	See Note 5	Argon	15	N/A	DCSP	50-150	8-14	N/A	3/8
	GTA	1/8	See Note 5	Argon	15	N/A	DCSP	50-150	8-14	N/A	3/8
Maximum thickness of any single deposited layer shall not exceed 1/2".											

PREHEAT TEMP. 60 °F (Min.)
INTERPASS TEMP. 60-350 °F
PREHEAT MAINT. 60 °F
TUNGSTEN ELECT. SIZE & TYPE 1/16-1/8 IN
EWTh 1 or 2

PEENING Not allowed
BACK GOUGING METHOD N/A
CONTACT TUBE TO WORK DIST. N/A IN
ORIFICE OR CUP SIZE 1/4 - 1/2 IN
WELDING PROGRESSION Upward

INSTRUCTIONS

1. Preheat and interpass temperature (above 150°F) shall be checked using temperature indicating crayons or an approved aqual.
2. Tack welds shall employ the parameters for the root pass.
3. Tack welds shall be complete fusion; the starts and stops shall be tapered by grinding so that the initial pass can properly consume the tack.
4. All welding shall utilize stringer beads.
5. Bare wire selected for the base metal to be welded shall be as follows:

BASE METAL TYPE	BARE WIRE TO BE USED
304 or 304L to 304 or 304L	ER308 or ER308L
316 or 316L to 316 or 316L	ER316 or ER316L
304 or 304L to 316 or 316L	ER316 or ER316L

For Westinghouse supplied Reactor Coolant Piping, ER308 will be used for base metal type 304 or 304L to 316 or 316L.

6. Purge requirement may be deleted for socket welds or when specified by the Project Welding Engineer.
7. Preheat maintenance shall be continuous during welding only; cool completed weld in still air.
8. Variation in the joint geometries shown above is permitted provided the joint is single or double welded and the root spacing maintained within the specified tolerances.

Brown & Root, Inc. HOUSTON, TEXAS		WPS NO. 88025

WELDING PROCEDURE SPECIFICATION CHANGE NOTICE

CURRENT REVISIONS ARE INDICATED BY CHANGE BARS.

REV.	DATE	ORIGINATOR	APPROVAL*
1	2-20-79	J. Bronicki	R P Culbertson
2	3-30-79	J. Bronicki	R P Culbertson
3	10-11-79	J. Bronicki	R P Culbertson

REVISION NO.	DESCRIBE THE CHANGE
1	Noted POR revision. Revised thickness range, joint details, maximum values of amps and volts and deleted reference to travel speeds.
2	Retyped on new form. Added the following information: fillet weld thickness and diameter, electrode - flux classification, preheat maintenance, joint description, trailing shielding gas, tungsten size and type, bead type, initial and interpass cleaning, back gouging method, oscillation and root spacing. Noted PQR revision. Added ranges to amp and volt values. Added Westinghouse requirement for RCP welds.
3	Added preheat maintenance, peening, root spacing, cup size ranges and notes 7 and 8. Noted PQR revision. Revised thickness range. Added layer thickness limitation.

* REVISIONS MUST BE APPROVED BY THE MANAGER OF MATERIALS ENGINEERING OR HIS DESIGNEE

Brown & Root, Inc. HOUSTON, TEXAS		WPS/PQR NO. 0809AA114

CHANGE NOTICE
PROCEDURE QUALIFICATION RECORD
QUALIFYING WELDING PROCEDURE SPECIFICATION

ESSENTIAL VARIABLES CANNOT BE CHANGED — CURRENT REVISIONS ARE INDICATED BY CHANGE BARS.

WPS/PQR	REV.	DATE	ORIGINATOR	APPROVAL*
PQR	1	[illegible]	[illegible]	[illegible]
PQR	2	[illegible]	[illegible]	[illegible]
WPS/PQR	3	[illegible]	[illegible]	[illegible]

WPS/PQR	REVISION NO.	DESCRIBE THE CHANGE
PQR	1	Deletion of heat input parameters and addition of Westinghouse WCAP-8678 reference.
PQR	2	Retyped on new form. Added the following information: WPS number, joint sketch & dimensions, O.D. range qualified, thickness range qualified per process, electrode size, electrode-flux class., consumable insert, welding progression, PWHT type & time range, purge flow rate, bead width, orifice or gas cup size. Changed "passes/side" to "multi or single layer", "number of arcs" to "multiple or single electrode". Deleted reference to "atmosphere trade name", "backing", and "who by virtue of these tests meets welder performance requirements". Changed filler trade name to "N/A". Information previously indicated under "oscillation" is entered under "bead width" and added "N/A" under oscillation. Changed shielding gas & purge flow rate from 20CFH min. to 20.
WPS	3	Deleted reference to supporting PQR and added peening, preheat maintenance and cup size range.
PQR	3	Change "thickness range qualified" to "deposited weld metal thickness". Added joint dimension information, tungsten size and type, peening and backgouging.

* REVISIONS MUST BE APPROVED BY THE MANAGER OF MATERIALS ENGINEERING OR HIS DESIGNEE

Brown & Root, Inc. HOUSTON, TEXAS

CODE: ASME SEC IX

Welding Procedure Specification No. 0808AA114 Date 3-13-78
Revisions 3

WELDING PROCESS(ES) 1 Gas Tungsten Arc TYPE Manual
2 N/A TYPE N/A

BASE METALS (QW-403)
P No. 8 Gr. No. 1 to P No. 8 Gr. No. 1
Thickness Range .187 thru 3.5 IN.
Pipe Dia. Range Unlimited

FILLER METALS (QW-404)
F No. 1 6 2 N/A
A No. 1 8 2 N/A
SFA Spec. No. 1 5.9 2 N/A
AWS Class. No. 1 ER308, 308L 2 N/A
Size of Electrode 1 N/A 2 N/A IN.
Size of Filler 1 3/32, 1/8 2 N/A IN.
Electrode – Flux Class N/A
Consumable Insert N/A

POSITION (QW-405)
Welding Position 2G
Welding Progression N/A

PREHEAT (QW-406)
Preheat Temp. 60 °F (Min.)
Interpass - Temp. Range 110-350 °F
Preheat Maint. 60 °F

JOINT DESIGN (QW-402)
Groove Design Double V
Joint Type OB Yes CI N/A BS N/A
Backing Matl Type N/A

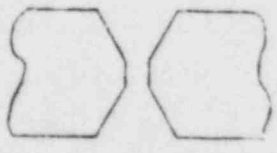
POSTWELD HEAT TREATMENT (QW-407)
Type N/A
Temperature N/A °F
Time N/A

GAS (QW-408)
Shielding Gas 1 Argon
Percent Comp. 1 100
Shielding Gas Flow Rate 20 Min. CFH
Purge Gas Flow Rate 20 Min. CFH
Trailing Shielding Gas Composition N/A

ELECTRICAL CHARACTERISTICS (QW-409)
Current 1 DCSP 2 N/A
Amps Range 1 100-130 2 N/A
Volts Range 1 9-14 2 N/A
Tungsten Elec. Size/Type 1/16"-1/8"/EWTh-1or2

TECHNIQUE (QW-410)
Stringer or Weave Bead 1 Stringer 2 N/A
Bead Width 1 3/8 2 N/A IN. (Max.)
Orifice or Gas Cup Size 1 1/4-1/2 2 N/A IN.
Initial and Interpass cleaning: Welding surfaces shall be wire brushed or ground as required to remove slag, scale or other contaminants.
Method of back gouging Arc air and/or Grinding
Oscillation 1 N/A 2 N/A IN.
Contact Tube to work distance N/A IN.
Multiple or Single Layer 1 Multiple
(Per Side) 2 N/A
Multiple or single electrodes Single
Travel Speed (Range) 1 2-6.0 2 N/A IPM
Peening Not Allowed

Sketch/Comments



Gap: 1/8"
Land: 1/16" + 1/32", -0
Bevel: 37-1/2° ± 2-1/2°

Prepared by Jerel Bernicchi 6-15-79
WELDING ENGINEERING DATE

Approved by R. P. Colbaugh /sfb 6-18-79
MATERIALS ENGINEERING DATE

Brown & Root, Inc. HOUSTON, TEXAS

PQR No. 0808AA114 Rev. 3

WPS No. 0808AA114 Rev. 3

PROCEDURE QUALIFICATION RECORD

WELDING PROCESS (ES) 1. Gas Tungsten Arc TYPE Manual

2. N/A TYPE N/A

BASE METALS (QW-403)

Matl. Spec. SA- 240 To SA- 240

Type or Grade 304L 304L

P No. 8 Gr. No. 1 To P No. 8 Gr. No. 1

Coupon OD N/A Thickness 1.75 Plate IN.

O. D. Range Qualified Unlimited

Deposited Weld Metal Thk. 1. 1.75 2. N/A IN.

Total Thk. Range Qualified .157 thru 3.5 IN.

JOINTS (QW-402)

Groove

Angle 75°

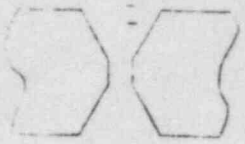
Land 1/16"

Root

Opening 1/8"

B. S.

Matl. N/A



(Joint Design Used)

FILLER METALS (QW-404)

F. No. 1. 6 2. N/A

A No. 1. 8 2. N/A

SFA Spec. No. 1. 5.9 2. N/A

AWS Class. No. 1. ER308, 308L 2. N/A

Size of Electrode 1. Not Recorded 2. N/A IN.

Size of Filler 1. 3/32, 1/16 2. N/A IN.

Electrode – Flux Class N/A

Consumable Insert 1. N/A

Trade Name N/A

GAS (QW-408)

Shielding Gas Argon

Flow Rate 25 CFH

Purge Gas Argon

Flow Rate 25 CFH

ELECTRICAL CHARACTERISTICS (QW-409)

Current 1. DCSP 2. N/A

Amps Range 1. 100-130 2. N/A

Volts Range 1. 11 2. N/A

Tungsten Elect. Size/Type Not Recorded

POSITION (QW-405)

Welding Position 2G

Welding Progression N/A

PREHEAT (QW-406)

Preheat Temp. 60 °F

Interpass Temp. 110-350 °F

POSTWELD HEAT TREATMENT (QW-407)

Type N/A

Temperature N/A °F

Time Range N/A

TECHNIQUE (QW-410)

Stringer or Weave Bead 1. Stringer 2. N/A

Bead Width 1. 3/8 Maximum 2. N/A IN.

Orifice or Gas Cup Size 1. 5/16 2. N/A IN.

Oscillation N/A 2. N/A IN.

Multi or Single Layer 1. Multiple

(Per Side) 2. N/A

Multiple or Single Electrodes Single

Travel Speed Range 1. 2.1-4.0 2. N/A IPM

Peening Not used

Back Gouging Method Grinding

TENSILE TEST

Specimen No.	Specimen Fig. No.	Dimensions (IN.) Width	Dimensions (IN.) Thickness	Area (IN.^{2})	Ultimate Total Load Lb.	Ultimate Unit Stress psi	Character of Failure And Location
1	QW-462.1(a)	1.002	1.614	1.617	144,700	89,487	Weld Metal
2	QW-462.1(a)	1.005	1.491	1.498	134,000	89,453	Weld Metal

GUIDED BEND TESTS

Specimen No.	Specimen Fig. No.	Specimen Type	Result	Specimen No.	Specimen Fig. No.	Specimen Type	Result
1	QW-462.2(a)	SB	Satisfactory	3	QW-462.2(a)	SB	Satisfactory
2	QW-462.2(a)	SB	Satisfactory	4	QW-462.2(a)	SB	Satisfactory

Welder's Name Curtis Marquis S.S. No. 260-64-1275

Laboratory Test No. 79-42

Test Conducted by B&R Materials Engineering Lab. Address 3109 Clinton Drive, Houston, Texas

per George Dawson Date March 9, 1978

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the requirements of Section IX of the ASME Code.

Signed BROWN & ROOT, INC. (Manufacturer)

Date 6-18-79 By R. P. Cullerton / WB

Brown & Root, Inc. HOUSTON, TEXAS		PQR NO. 080-VA-14

SUPPLEMENTAL TEST RESULT CHANGE NOTICE

CURRENT REVISIONS ARE INDICATED BY CHANGE BARS

REV	DATE	ORIGINATOR	APPROVAL*
1	9-20-79	J. Bronicki	
2	4-3-79	D. Stupi	
3	6-18-79	J. Bronicki	

REVISION NO.	DESCRIBE THE CHANGE
1	Deletion of heat input parameters and addition of Westinghouse WCAP-8076 reference.
2	Typed on new form.
3	Added testing laboratory, lab test no, and testing date.

* REVISIONS MUST BE APPROVED BY THE MANAGER OF MATERIALS ENGINEERING OR HIS DESIGNEE

BROWN & ROOT, INC. HOUSTON, TEXAS	Doc. No. 08-NM-14	Rev. 3
SUPPLEMENTAL TEST RESULTS	Project CPSES	Job No. CR-0172

CHEMICAL ANALYSIS% METHOD Wet Chemical PER ASTM E350-74

ELEM.	C	Mn	Si	Ni	Mo	Cr	N	Cb
WELD	.013	1.61	.35	9.38	.07	19.96	.0586	<.01

SENSITIZATION

Two (2) specimens were sensitization tested in accordance with ASTM A262-70, Practice E. Specimens were examined at 20X magnification for presence of microcracking. No fissures were present.

MICRO FISSURE

Bend test were examined at 10X magnification after bending to meet the acceptance criteria of "Interim Regulatory Guide 1.31." No fissures were present.

DELTA-FERRITE

Delta-Ferrite tests were conducted at twelve (12) points (six per side) along the length of the procedure qualification coupon. Feritescope MET/725 was used and the following results noted:

All positions ranged between 9.5 and 11.5 FN.

Approximate Delta Ferrite Content; 10% (Schaeffler Diagram per Figure 2433-1 of the ASME Section III Code)

Test conducted by B&R Materials Engineering Lab. Lab No. 78-42

Address: 3100 Clinton Drive, Houston, Texas

per George Dawson Date March 9, 1978

We certify that the statements in this record are correct and that the test welds were prepared, welded and tested in accordance with the above listed PQR and per requirements of the listed code/standard(s).

Signed Brown & Root, Inc.

Date 6-18-79 By R. P. Colter /CB

the necessary Procedure Qualification Record(s) (PQR).

S77 S78 **QW-201.2 Procedure Qualification Record (PQR).** The specific facts including the base metal specification Type and Grade (or chemical analysis and mechanical properties), and the essential variables (as listed in QW-252 through QW-282) used in qualifying a WPS shall be recorded in a form called Procedure Qualification Record (PQR). This form shall also record the test results.

It is required that the essential and nonessential variables of a WPS be followed in welding the test coupons. The WPS identification (including date and revision number) shall be listed on the PQR. These documents shall be certified by the manufacturer or contractor and shall be available for examination by the Authorized Inspector. A suggested format is given in QW-483. This PQR format may be changed to fit the needs of each manufacturer or contractor.

A change in any essential variable shall require requalification, to be recorded in another PQR. A change in any nonessential variables does not require requalification. A change from one welding process to another welding process is considered a change in an essential variable.

QW-201.3 Combination of Welding Processes or Procedures. More than one process or procedure may be used in a single production joint. Each welding process or procedure shall be qualified either separately or in combination with other processes or procedures (within the thickness limits specified in QW-202.2, QW-403, and QW-451) for the base metal thickness and for the deposited weld metal thickness range for each of the processes or procedures to be used in the production joint. For multiprocess or multiprocedure applications, the qualified thickness of each process or procedure shall not be additive in determining the maximum thickness of the production joint to be welded. One or more processes or procedures may be deleted from a production joint qualified by a combination of processes or procedures provided each remaining process or procedure has been, in the specific combination welding process or procedure qualification, qualified (within the thickness limits specified in QW-202.2, QW-403, and QW-451) for the deposited weld metal thickness range for each of the processes or procedures to be used in the production joint.

QW-202 Type of Tests Required

QW-202.1 Mechanical Tests. The type and number of test specimens that must be tested to qualify a welding procedure are given in QW-451, except that, where qualification is for fillet welds only, the requirements are given in QW-202.2 and, where qualification is for stud welds only, the requirements are given in QW-202.3. All mechanical tests shall meet the requirements prescribed in QW-150, QW-160, QW-170, or QW-180 as applicable. S77

QW-202.2 Base Metals—Groove and Fillet Welds. Except for vessels or parts of vessels constructed of P-11 (excluding P-11A Subgroup 1 and 2) metals, WPS qualification tests for groove and fillet welds may be made on groove welds using reduced-section tension specimens and guided-bend specimens. The groove-weld tests shall qualify the WPS for use with groove welds within the range of essential variables listed. Groove-weld tests shall also qualify for use with fillet welds in all thicknesses of metal, sizes of fillet welds, and diameters of pipe or tube, within the other remaining applicable essential variables. Where a WPS qualification of fillet welds only is required, tests shall be made in accordance with QW-180. The tests shall qualify the fillet WPS for use only with fillet welds in all thicknesses of metal, sizes of fillet welds, and diameters of pipe or tube, for use within the other remaining applicable essential variables.

For vessels, or parts of vessels, constructed of P-11 (excluding P-11A Subgroup 1 and 2) metals, WPS qualification tests for groove welds shall be made on groove welds, using reduced-section tension specimens and guided-bend specimens. The groove-weld tests shall qualify the WPS for use only with groove welds within the range of essential variables listed. WPS qualification tests for fillet welds shall be made in accordance with QW-180. The tests shall qualify the fillet WPS for use only with fillet welds in all thicknesses of metal, sizes of fillet welds, and diameters of pipe or tube, for use within the other remaining applicable essential variables.

Groove weld procedure qualifications shall encompass thickness ranges to be used in production, for both the base metals to be joined or repaired and the deposited weld metal to be used, except as allowed in (1) below for both the base metal and the deposited weld metal.

(1) For welding procedure qualifications made with the SMAW, SAW, GTAW, GMAW, or PAW welding processes, using weld layer(s) of ½ in. (13 mm) or less in thickness, there is no limit on the minimum depth of deposited weld metal for repair or

ATTACHMENT 3

"built-up" welding, nor on the minimum thickness of the thinner of the base metals being joined where they are of dissimilar thickness, and groove weld procedure qualifications made in base metal having a thickness of 3/4 in. (16 mm) or more shall be applicable for production use for deposited weld metal thickness up to the maximum given in QW-451 for:

(a) Repair or "built-up" welds in any thickness of base or weld metal, with no limit on the minimum depth of deposited weld metal, and

(b) Welds joining dissimilar thicknesses of base metals in which the base metal on one side is equal to or less than the maximum thickness qualified in the

QW-202.3 Stud Welding. Procedure qualification tests for stud welds shall be made in accordance with QW-192. The procedure qualification tests shall qualify the welding procedures for use within the range of the essential variables of QW-261. For studs welded to other than P-No. 1 metals, five additional welds shall be made and subjected to a macro examination, except that this is not required for studs used for extended heating surfaces.